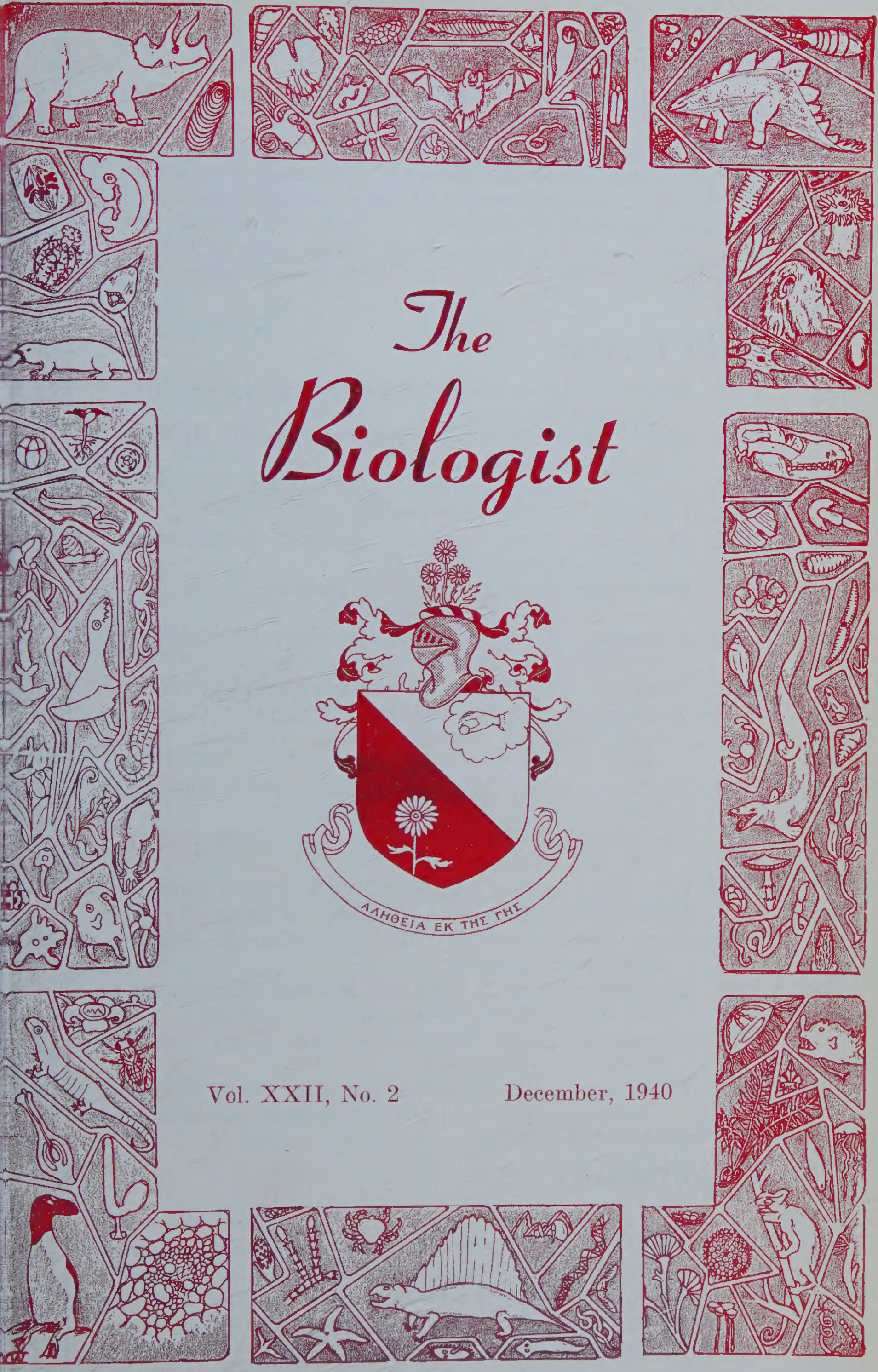
COLE—GENERATIONS TO COME



The Biologist

Vol. XXII, No. 2 December, 1940

IUBBS—FISHES OF THE DESERT

Phi Sigma

BIOLOGICAL HONOR SOCIETY

"The object of Phi Sigma is to promote interest in biological research. Although originally designated as an honorary biological research society, it should now be considered as a working guild of biologists interested in research. In effect, election to Phi Sigma should be an opportunity for better work, rather than merely election to an honorary society."

Mile Posts:

1915 March 17, Alpha Chapter organized, Ohio State University, Columbus.
1916 May, Central Governing Body organized, BIOLOGIST first issued.
1917 June, last War-time BIOLOGIST issued.
1921 February, BIOLOGIST revived.
1924 December, First National Meeting, Constitution revised, Washington, D. C.
1925 December, Second National Meeting, First Science Program, Kansas City.
1926 December, Third National Meeting, Second Science Program, Philadelphia.
1927 December, Third Science Program, Nashville.
1928 December, Fourth National Meeting, Coat-of-Arms adopted, Fourth Science Program, New York.
1930 January, Council Meeting, Ritual Revised, Norman, Okla.
December, Fifth National Meeting, Fifth Science Program, Cleveland.
1931 Phi Sigma Letters Registered, U. S. Patent Office.
1932 December, Sixth Science Program, Atlantic City.
1933 June, Sixth National Meeting, Seventh Science Program, Chicago.
1935 December, Seventh National Meeting, Eighth Science Program, St. Louis.
1937 December, Eighth National Meeting, Ninth Science Program, Indianapolis.
1939 December, Ninth National Meeting, Tenth Science Program, Silver Anniversary, Ohio State University, Columbus.

Expansion:

The Constitution provides that: "An active chapter may be established in any institution of learning which requires for graduation the equivalent of four years of collegiate work, and which is equipped with facilities for research work. - - - - Any petitioning group must be active for at least one year before it may be granted a charter."

THE BIOLOGIST

Vol. XXII Denver, Colo., December, 1940 No. 2

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OF ALL ACTIVE AND INACTIVE CHAPTERS

The list of chapter officers for this school year will be found in the CHAPTER NEWS section of Vol. XXII, No. 1.

ALPHA

Ohio State University, Columbus, Ohio, founded March 17, 1915, (Inactive).

BETA

University of Michigan, Ann Arbor, Michigan, founded June 3, 1916.

DELTA

University of Maine, Orono, Maine, founded January 27, 1917, (Inactive).

EPSILON

University of Denver, Denver, Colorado, founded March 5, 1917.

ZETA

University of Wisconsin, Madison, Wisconsin, founded May 30, 1917

ETA

University of Akron, Akron, Ohio, founded April 20, 1921.

THETA

Michigan State College, East Lansing, Michigan, founded April 9, 1921, (Inactive).

IOTA

Washington University, St. Louis, Missouri, founded May 28, 1921.

KAPPA

University of Kansas, Lawrence, Kansas, founded May 31, 1921.

LAMBDA

Montana State University, Missoula, Montana, founded May 4, 1921.

MU

University of California, Berkeley, California, founded April 27, 1922.

NU

Washington and Jefferson College, Washington, Pennsylvania, founded May 11, 1922

XI

University of Nebraska, Lincoln, Nebraska, founded May 3, 1934, (Inactive).

OMICRON

University of North Dakota, Grand Forks, North Dakota, founded May 26, 1924, (Inactive).

PI

Emory University, Georgia, founded January 3, 1925.

RHO

University of Illinois, Urbana, Illinois, founded March 28, 1925.

SIGMA

University of Florida, Gainesville, Florida, founded December 4, 1925.

TAU

Duke University, Durham, North Carolina, founded March 4, 1926.

UPSILON

Miami University, Oxford, Ohio, founded May 7, 1926.

PHI

University of New Hampshire, Durham, New Hampshire, founded May 21, 1926.

CHI

Montana State College, Bozeman, Montana, founded February 11, 1927.

PSI

University of Washington, Seattle, Washington, founded April 7, 1928.

OMEGA

University of Oklahoma, Norman, Oklahoma, founded March 24, 1928.

ALPHA ALPHA

University of Southern California, Los Angeles, California, founded May 17, 1930.

ALPHA BETA

Mount Union College, Alliance, Ohio, founded May 17, 1928.

ALPHA GAMMA

University of South Dakota, Vermillion, South Dakota, founded May 15, 1928, (Inactive)

ALPHA DELTA

Lawrence College, Appleton, Wisconsin, founded March 7, 1929, (Inactive).

ALPHA EPSILON

University of Pittsburgh, Pittsburgh, Pennsylvania, founded March 23, 1929.

ALPHA ZETA

College of William and Mary, Williamsburg, Virginia, founded April 19, 1930, (Inactive).

ALPHA ETA

Oklahoma Agricultural and Mechanical College, Stillwater, Oklahoma, founded March 13, 1930.

ALPHA THETA

State College of Washington, Pullman, Washington, founded May, 1930.

ALPHA IOTA

Bucknell University, Lewisburg, Pennsylvania, founded January 9, 1932.

ALPHA KAPPA

Hunter College, New York City, founded January 8, 1932.

ALPHA LAMBDA

University of Utah, Salt Lake City, Utah, founded February 13, 1932.

ALPHA MU

University and State College of Oregon, Eugene-Portland-Corvallis, Oregon, founded November 18, 1933.

ALPHA NU

University of New Mexico, Albuquerque, New Mexico, founded April 21, 1935.

ALPHA XI

Rhode Island State College, Kingston, Rhode Island, founded May 17, 1935.

ALPHA OMICRON

Marquette University, Milwaukee, Wisconsin, founded June 18, 1938.

Generations to Come*

LEON J. COLE, Honorary National President of Phi Sigma

It may appear presumptuous, and very likely it is, for one who has long specialized in animal genetics to address you on the subject of human genetics and its relation to human populations. Questions of human population are popularly considered as lying in the fields of sociology and economics, and in those rarified climes I can claim no proficiency nor authority whatever. For my temerity I may perhaps take refuge in the "Apology" offered by R. A. Fisher for his thought-provoking chapter on "Conditions of Permanent Civilization" in his book *The Genetical Theory of Natural Selection*. He says, "It is to be supposed that all scientific men accept, at least in theory, the view that the advancement of biological knowledge [presumably he means in any field] will ultimately be of service in the practical affairs of mankind; but," he adds, "there can be little doubt that most would feel some embarrassment if their views had to be made the basis of practical, and therefore controversial, policy." With this second statement I can wholeheartedly agree, so you may as well be forewarned at the start not to expect from me any formula for the cure of the at-present decidedly ailing human social organism.

But after all, man is an animal—he can't escape that fact. Perhaps that is in large part what is the matter with him; his feet are mired in a heritage involved in milleniums of slow and painful evolution. Furthermore, at least the genetic principles that govern man's heredity and the composition of his groups or "populations" are essentially the same as for his more lowly brethren, whether domesticated or wild. Such being the case, I may, I trust, be pardoned for giving some consideration to those natural, organic laws by which he is still bound and which have likely played a larger part in the history of civilization than is generally recognized.

Characteristics of populations

Population, like most phenomena, has its quantitative and qualitative aspects. Quantitative description counts and records the number of persons living in a given area or in different areas at a specified time or times. Such a datum is provided by a simple enumeration census. It is the resultant of three factors, viz., births, deaths and migrations—or, if we include death as a part of the reproductive cycle, we may say two factors, reproduction and migration. The analysis may be extended by considering separately the different sub-categories that compose the population. Thus, the individuals in any area may be grouped according to age, sex, economic status, health, racial origin, or any other differential. Insofar as these groupings are based on character differences, the description tends to assume qualitative attributes. But it is still static; it may describe the population in some detail yet give no information as to what it is likely to become in succeeding generations. While such a description is of interest and has great value for certain purposes, it is the dynamic feature of population which concerns the future. To forecast what that future may be, we must have not only a description of the population as it exists but also a knowledge of the forces which have produced it and which may be effective in making it different.

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* Address to Zeta Chapter of Phi Sigma, Madison, Wisconsin, May 23, 1940.

Pearl has tritely remarked that, "More population is made only by existing units of population." While generally true, this is not a complete statement when applied to prescribed areas, for as we have seen, in a state like Wisconsin, for example, the population at any given time is not derived exclusively from units pre-existing within the state, but embodies increments from without, which may be quite different and wholly unrelated to the elements already present. His statement does, however, emphasize what is perhaps after all the most important single attribute in determining the qualitative character of populations, namely, their biological genetic continuity. There is, of course, also a cultural continuity which is genetic in a non-biological sense, in that it has its origins and development in what has preceded. It has evolved concurrently with organic evolution, though there are those who assert that when man began to develop an effective culture his organic evolution stopped; that when the mind reached the stage at which it possessed powers of ratiocination, it was thenceforth fully capable of acquiring the cultural lore and achievements as they developed and to build on them. The brain had "arrived"; further progress was taken over by cultural evolution and the brain simply "stayed put!" In proof of this it is often cited that we have no evidence that there are any better brains in the world today than were possessed centuries ago by some of the able philosophers in the heyday of Greek civilization. On such a premise has arisen the psychological school of "behaviorists" and the philosophy that dominates the Soviet Marxists.

Physical and cultural evolution

The important part played by cultural development cannot be denied. It has been enormously more conspicuous and undoubtedly far greater in amount than the innate physical or mental change that has taken place in man since the dim beginnings of history. Let us admit, for the sake of argument, that in that remote period there were individuals endowed with mental faculties equal to any existent today. This implies that such an individual, transplanted as an infant into present-day civilization and given the best advantages of education, would stand at the head of his class and would be an intellectual leader in science or whatever calling he might choose. Possibility that such might be the case does not seem at all unlikely. Furthermore, we have no evidence that man is any better physically today than he was at that time; in fact, it is rather generally assumed that physically he has deteriorated, if anything. Such information as we have, however, would seem to indicate that he was subject to about the same ailments then as now. Leaving aside the frequency of occurrence of the different characters—intellectual ability, deformities, diseases and what not—we have then no real evidence that mankind, taken as a whole, has changed markedly in its innate characteristics for many thousands of years.

But probably even the most enthusiastic and ardent "behaviorist" would not maintain that *any* infant of those early times transplanted into the present would reach the attainments of our postulated philosopher;

indeed such a prodigy may have been much more of an *avis rara* in those days than would a comparable infant today. At any rate, if initial innate intellectual differences are admitted, the problem at once becomes in considerable degree one that is familiar to every intelligent breeder of livestock. It is that populations which may not differ in the hereditary qualities (genes) which they encompass, may yet differ very markedly in the proportions of those qualities as distributed among the individuals comprising the population. Thus, while *gene frequency* is a purely quantitative relationship, it nevertheless may affect profoundly the qualitative characteristics of the population as a unit.

Gene frequency

Since Wisconsin is a dairy state let us choose a dairy example, which will be reduced to a hypothetically simple form. Assume that milk production is inherited at two distinct levels, *high* and *low*, which are based on a simple hereditary mechanism. The dairyman can modify these abilities by management and feeding, but he cannot in that way, by any means at present known, make a genetically high producer out of a genetically low. Under these circumstances, while the same genes are present in both herds but in different proportions, Farmer A, who has 90 high producers and 10 low has a decided economic advantage over Farmer B with a herd of only 10 high producers and 90 low. It is not in this case a question whether A has any *higher* producers than has B, but is purely a matter of the relative numbers in the two classes.

How may Farmer B improve his herd and bring it to a comparable basis, so that it may compete with the herd of Farmer A? He might, of course, buy 80 high producers to add to his herd. This would correspond to migration in a population. It would give B as many high producers as A, but unless he disposed of an equal number of his low cows he would still be at a disadvantage, for his herd would now consist of only 50 per cent high producers whereas A has 90 per cent high.

The comparison with human affairs is too obvious to need elaboration. A society can better educate and will get more return from 90 per cent bright children and 10 per cent morons than it can from a population half of whom are morons. But the analogy cannot be pushed too far. Farmer B could complete his endeavor to equalize with A by disposing of his 80 low producers. Society does not allow of thus disposing of its morons, nor would anyone suggest such a course.

But Farmer B has another means of improving his herd. It will take time but in the long run is effective. With rare exceptions in heredity, the progeny of any selected parents tends to resemble those parents more closely than would the offspring of average or unselected parents. Continued selection, therefore, by accumulating more of the genes for which selection is being made, tends to move the mean of the population in the direction of the selection. This is not only good genetics but it is the experience of centuries of practical breeding of animals and plants. All Farmer B has to do then is to make sure that his high cows reproduce and thus pass their better heredity on to the next generation, while the low cows are prevented from breeding. By this process he may expect to make progress so long as the differences with which he is dealing are due to hereditary determination.

Eugenics programs

To early writers on eugenics the conclusion appeared obvious. All that is necessary for race improvement is to assure that the superior elements in the population shall contribute relatively more offspring to succeeding generations and the inferior elements less. The proposition is simplicity itself and there can be little doubt of its effectiveness if it could be put into operation. But less visionary—or, at any rate, less optimistic—persons have raised a number of embarrassing questions, such as: Who are the superior persons and who the inferior? Who will make the determination and by what means? What "races" are to be "improved" and in what way? Will each have a different goal or will mankind all be shaped towards one end? And what end? Inability to answer these questions has reduced the constructive eugenics program largely to a matter of "wishful thinking."

We have already noted the increasing part played by cultural evolution in man's later history. Some, impressed by the marvels of modern science, anticipate that the influence of heredity in the development of physical characteristics will similarly be largely, if not wholly, supplanted by biological and medical discoveries. They ask, if the dentist can supply artifices to take the place of faulty teeth, glasses to correct distorted or otherwise imperfect vision, and insulin to aid the diabetic to metabolize sugar, why may not all physical disabilities ultimately be corrected in this way? Even more, why may not some hormone or other treatment eventually be found which will transform the brain of an Australian Bushman or a congenital idiot into that of a scholar? Science is truly wonderful and he would be a rash prophet who would venture to set its limit; but it would seem far simpler to breed brains than to start a never-ending process of getting them by shooting hormones into idiots and Bushmen, for no matter how much attainment might be injected into them, their germ plasm would still carry the defective trait and would pass it on to their progeny.

There are others who would challenge even this last statement. These are the believers in the "inheritance of acquired characters." They believe, or profess to believe, that if the environment is corrected the beneficial effects will eventually be automatically incorporated into the heredity. This appears to be the other leg on which Soviet philosophy stands. An adequate discussion of the subject would take altogether too long—suffice it to say that the summation of experience and controlled experimentation and the overwhelming weight of competent biological opinion make it appear a lamentably weak limb on which to bear weight, much less, by means of which to make any rapid or permanent progress. Least of all may it be anticipated as a panacea—it smacks too much of faith cure.

Selection

To the geneticist the fact that selection is still operative in man, just as it is in his domesticated animals, is a self-evident truth that may be accepted without necessarily attempting to assign to heredity and environment their respective roles in the development of particular characters. Suffice it to say that both are concerned in every case. On some characters the normal range of the environment has little effect. This is true, for example, of eye color. In others the environment may produce a wide range of effects on the same hereditary base, even to preventing the expression of the character altogether. Such characters can develop their optimum only under the most favorable conditions. Thus the social environment is one of the most important factors in the development of the innate faculties of the individual. As Hogben puts it, "The most brilliant intellect is a prisoner within its own social inheritance."

Selection is the determination or choice of the individuals who shall be the parents of the next generation. Where this determination is by natural causes, without the conscious intervention of man, it is called Natural Selection. When man deliberately takes a hand in the choice, whether it be with plants or animals, or in his own species, it may be distinguished as Conscious Selection. The difference is largely one of degree, and natural selection must be considered as still largely operative in man. He has in the course of his cultural development affected profoundly some of the elements of determination, but it cannot be said that this has been done with any particular thought to the consequences.

Selection, as practiced in any population, may be considered in two aspects. If it more or less directly determines the individuals which shall be the parents of the next generation it is spoken of as *positive;* if it accomplishes essentially the same end by preventing the reproduction of those individuals which it is desired shall not contribute to posterity it is *negative selection.* Similarly, plans for improving the inherent qualities of the human race are often classed as *positive eugenics*, which would encourage or otherwise ensure a preferential reproductive efficiency of the genetically superior, and *negative eugenics*, which would discourage or eliminate from reproduction the less fit element of the population.

Negative Eugenics

Negative eugenics corresponds to what the breeder terms "culling," and may be illustrated by referring to our previous example. Both Farmers A and B might have improved the heredity of their herds very materially by eliminating all their low producers at the start. The number of genetically low producers in the next generation would thereby have been greatly reduced.

The effectiveness of negative selection, and consequently of negative eugenics, depends on the nature of the characters involved. When the mode of inheritance is simple and the development of the character relatively uninfluenced by environmental factors, it may be very effective. This is particularly true of dominant traits. Thus brachydactyly, or short fingeredness, could be eliminated from a population in a single generation if no individual having the condition were to reproduce. Saying that it could be done is quite different from advocating that it should be done; for those stubby-fingered individuals might well possess other very desirable traits, in which case the elimination of their contribution from the "body genetic," if we may use the term, would be a distinct loss, possibly outweighing the gain. A different situation is presented by Huntington's chorea, a form of insanity, which no one would deny the desirability of eliminating. But while this affliction appears also to be inherited as a simple dominant, it ordinarily does not appear till mid-life, by which time the affected individual may already have married and produced children to continue the trait indefinitely.

The majority of defective traits to which it is proposed that negative eugenics should be applied are recessive in their inheritance. There are many such inherent differences in individuals in respect of their ability to become useful members of society. Some of these individuals are so defective in physical character or so low in intellectual possibilities there would be practically universal agreement that the world would be better if it had fewer of them. Thoughtful persons believe that they should be cared for but should not be allowed to perpetuate themselves. Whether this should be accomplished by segregation or by sterilization is a problem of sociology, not of genetics. Two objections that do concern genetics are, however, frequently raised. The first is that in cutting off any stock a genius might be lost to the world. To answer this it may be pointed out that there are innumerable chances of geniuses not coming into the world or of being prematurely eliminated from it to which we give little thought. Surely, for example, society should have more fear of losing unborn geniuses when it sends the flower of its youth off to war than if it prevented the propagation of its defectives. The other objection is that negative eugenics is too slow in its action to be of any real use. This is because only the individuals showing the recessive trait are recognizable and hence many outwardly normal individuals carry the heredity and will continue to transmit it. It is true that the process becomes increasingly slow as the number of heterozygotes in the population becomes small, and theoretically the responsible genes would never be completely eradicated. But this argument of futility reminds me of the man in a leaky boat who had nothing but a sardine can for a bailer. By working hard he could reduce the water in the boat gradually, but when it got down to the bottom boards he could no longer get at it. Seeing no hope of getting his craft completely dry he gave up all effort, crawled up on a thwart and went to sleep. While he slept the boat filled and sank!

Positive Eugenics

At best, negative eugenics is like throwing the ballast out of a balloon; the decrease in weight allows the balloon to go higher. The height it will reach is then determined by the amount of gas it contains. To make it rise still higher its buoyancy must be increased by some positive means. Just so, eugenists feel that negative eugenics needs to be supplemented by positive eugenics. Decreasing the fertility of undesirables will help, but at the same time the "desirable" element of society should be induced to increased fertility. This again raises the question, Who are the desirables and who the undesirables? And, whereas the reproduction of the latter may be rather effectually controlled, how is the reproductivity of the former to be stimulated? Thus far we have considered extremes so different that probably no one would deny the distinction between them. The simple solution is to sterilize the one and urge upon the other its duty to replenish the earth. Unfortunately, this plan meets with persistent obstruction largely on dogmatic religious grounds on the one hand, while on the other, its desirability is readily admitted but few are so unselfishly public spirited as to do much about it under existing economic conditions.

The problem is tremendously complicated by the fact that between the extremes that have been used thus far there exists a whole range of intergrades with differing characteristics, some of which may be desirable and others not. Furthermore, we know little as to what of these finer distinctions are hereditary and what are not but are due to environmental and cultural differences. Who can say which of these people should be encouraged and which should be discouraged in fertility? The experimentalist would say that ideally every child should be given the fullest opportunity for development of his innate abilities (stabilizing the environmental variable) and then classified and socially rewarded and encouraged to increased fertility, according to his value to society. Our democracies have made a beginning towards giving each individual an opportunity to express his capabilities by making education available and free, even compulsory, for all. While there is no question of the great advance in this, our educators are among the first to admit that there are still many social and educational imperfections in the system. Nor is one who has gone through this genetic test (assuming that environmental differences have been ironed out and opportunity made truly equal) at all assured of obtaining economic and social advantages in accordance with his proven ability. He may graduate at the head of his class only to find that no job requiring his talents is available and he is thrown back into competition with brawn, for which he may or may not be fitted. In any case, his particular abilities are not being used to the fullest, which is a sore disappointment to him and a waste to society.

The first important step in the establishment or improvement of a breed of animals, cattle for instance, is the setting up of an ideal which it is hoped to attain. This prescribes the color, size, conformation and production desired and is known as the breed standard. Progress is made by eliminating from the breed all animals which do not meet the minimum requirements, and favoring the reproduction of those which possess the desired characteristics in highest degree. By such means, a breed of cattle can be changed from red to predominately black or from low production to a much higher average production in a relatively short time. There is no reason to suppose that similar results might not be accomplished with mankind if some superbreeder had the power and knew what he wished to select for. But in addition to power as a superbreeder, he would need a superintellect, for who can say what manner of man is needed to meet the ever-increasing complexities of our future civilization? The chances are our genetic dictator would produce a type so specialized its inability to meet unforeseen conditions would ultimately lead to its extinction. Whatever our dislike or fear of dictators, it is not likely they will go this far, for the process carries within itself the seeds of its own destruction. We may expect that for the most part mankind will continue to muddle along much as Nature does with respect to heredity, for Natural Selection is after all a muddling process. It is profligate of materials and consuming of time—but Nature can afford to be prodigal with her materials and she recks not of time. Man differs from other animals, however, in that he has not been satisfied to let Nature take her ponderous and impersonal course in all things. He has made great strides in altering his environment to suit his needs and in changing the heredity of his plants and livestock for his uses. At the same time, his own relation to selectional processes has been profoundly altered.

In its simplest form, Natural Selection favors greater opportunities of reproduction of those individuals possessing in greatest degree characters having direct survival value. The process is complicated and much less direct in the colonial organization of such insects as the ants, bees and termites. In these, specialization of function, and especially of the reproductive function, has changed completely the emphasis in selection. The reproductive survival value of the sexual individuals depends not on their own ability to perform the work of the colony—food gathering, defense, care of the young—but solely on their ability to produce colonies of sexless individuals which can excel in those functions. Reproduction and survival value, in the sense of contribution to the well-being of the group, are, however, still tied together. In man this often no longer is the case. If by chance a primitive man acquired a mutation which rendered him immune to some prevailing disease, he was thereby individually benefited, since his chances for survival were increased. His social unit was benefited only to the extent to which he passed his favorable mutation on to his descendants and it so became incorporated in the germ plasm of his tribe or race. In modern society, instead of waiting for heredity to provide security from the disease, some worker in his laboratory perfects a serum which gives the necessary protection. It is not necessary to await the slow and uncertain processes of hereditary transmission to pass the boon on to his fellow beings, but by use of the serum the whole population may be protected at once, and the knowledge is passed to future generations. The original discoverer ordinarily receives little personal benefit; in fact, it is not unusual for him to lose his own life in the course of making the discovery. At best he receives an economic reward which enables him to provide for perhaps one or two children. His effective contribution to society has been to its culture and not to its germ plasm. Furthermore, his efforts may have resulted in saving the lives of many hereditary defectives whose cultural contributions to society will be nil or worse, but whose defective genes will perpetuate themselves through succeeding generations. Surely here is food for serious thought, for the remedy is not clear.

Differential fertility

The hypothetical illustration just given is an example of the way in which modern civilization tends to throw the reproduction of society into reverse. This question of differential fertility has received much serious consideration. There is abundant evidence that the less efficient members of each generation are contributing more than their share of progeny to the next, whereas it would undoubtedly be for the general good if they contributed less, and in extreme cases, not at all. The difficulty is how to correct the situation and bring about a re-reversal. The problem is extremely complicated for reasons that have already been mentioned. We have no "breeding standard," and no classification of social worth except in the most general terms. The presumably more desirable elements are sometimes referred to as the more able, superior, more successful, rich, socially prominent, more fit, upper, with superior intelligence and physique, or having a higher I. Q. Contrasting with this we have inferior, lower, less successful, poor, unfit, and so on. There is objection to making our selection on the basis of any pair of these terms since absence of one quality does not insure that all the others will be lacking as well. A man may be poor, or unsuccessful at some things and unfit for others, and still be a most valuable asset to society. Should his natural fertility be restricted and penalized for these reasons? Or if we were to measure civic worth by the standard of economic return we should presumably have to put Hollywood stars at the top, perhaps with "robber barons" second and gangsters running them a close third.

Fortunately there are inherent factors which tend to restrict the fertility of the too successful, so that presumably there is little cause to worry about that class. If they are subject to the degenerative influences of great wealth they are taken care of automatically; if in spite of wealth they recognize their social obligations to this and succeeding generations, their contribution should tend to be eugenically sound.

Under more primitive conditions there was presumably a somewhat similar automatic elimination at the lower end of the scale. The higher birth rate was counterbalanced by a correspondingly greater death rate. Apparently this automatic check has been upset and the problem is how it may be replaced. No one, of course, would advocate a return to higher rate of infant mortality to restore the balance, but it would seem that in some way the great middle class should be encouraged to increased reproduction while the obviously incompetent should be encouraged to a lower reproductive rate—to put it euphemistically. Some schemes have been proposed which would tend in this direction, but they have been planned for economic reasons or merely to stimulate an increase in population rather than for their eugenic effect. Such is the French system of family allowances, which pays a bonus in direct relation to the economic status (salary income) of the parents, rather than in inverse proportion as is the effective result of our systems of relief. This may be a first halting step in the right direction; certainly it is a principle worth careful study and consideration as to its possible usefulness and extension. Such study needs to be undertaken seriously if we are ever to assume a conscious, intelligent and directive interest in our destiny. The ultimate fate of mankind will undoubtedly work itself out in some way, even though we are indifferent to the outcome and everything is left to chance and to Natural Selection as expressed in the "struggle for existence" between rival civilizations and ideologies, which seems to be occupying most of the world today. But if we are concerned with our own particular civilization and hope to see it continue and improve we should be concerned also with who and what manner of mankind shall succeed us.

Quo vadimus?

In closing it may be of interest to consider briefly some of the ideologies that lie back of the clashing forces in the world today. The political philosophy in Russia appears to be based on the theorem that heredity is of little importance and that regulation of environment can accomplish everything. Whether by this means all are to be brought to a similar state of perfection is not clear, but available reports do not indicate that great progress in that direction is being made.

The Germans, on the other hand, take heredity very seriously, so much so in fact that they go to absurd and tragic lengths in their conceptions of race and genetic racial differences. Their interpretation of Natural Selection is literal in its application of Darwinian dogma to human affairs,—survival proves superiority; domination assures survival; it is not only a right but a duty to survive; therefore domination is to be attained by any means whatever. Might is right and all other values, as between nations at least, are thrown into the discard. One is reminded of the extract from the "Moral Essay" in the history of Penguinea:

> "Arriving we know not from whence (for indeed their origins are not very clear), and successively invaded and conquered by four or five peoples from the north, south, east, and west, miscegenated, interbred, amalgamated, and commingled, the Penguins boast of the purity of their race . . .
>
> "This idea that they belong to the best race in the world, and that they are its finest family, inspires them with noble pride, indomitable courage, and a hatred for the human race."

And what of the democracies? Have they perhaps taken too literally the dictum that all men are created equal? At any rate they have proceeded on the social philosophy that the duty of the State is to improve the condition of all its citizens in so far as possible. The most obvious need of improvement is at the bottom and there most of the direct help has gone. What about a eugenic philosophy? They have mostly had none and they display a curious apathy to the suggestion that anything of the sort is needed. Possibly, while we are giving so much of our attention and money to preparedness it might be well to give some thought at the same time to those *Generations to Come.*

Dr. Higbee Appointed Acting Editor

The several chapters of Phi Sigma will be interested to learn that the National Council has appointed Dr. Edna Higbee, of the Biology Department at the University of Pittsburgh, Acting Editor of the Biologist. Dr. Higbee has been active in Phi Sigma for several years and has constantly been helpful in many ways. She has consented to undertake this rather difficult job, and the National Council asks that the chapters give her their whole-hearted cooperation. All letters concerned with the Biologist should in the future be addressed directly to Dr. Higbee.

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Fishes of the Desert*

CARL L. HUBBS

In our study of the fishes which inhabit the isolated waters of the arid American west, an effort is being made to integrate ichthyological facts with a knowledge of the past and present physiography of this desert region; and, through this liaison between the two sciences, to increase our understanding of the processes involved in the origin and differentiation of species. Mindful of the heterosis (or hybrid vigor) that so often characterizes the offspring of diverse parents, I am hoping that this research may produce results which would not have been obtained through inbred studies within one discipline.

This integration of ichthyology and desert physiography is a two-way process. Physiographic evidence brings essential contribution to the analysis of the systematics, distribution and history of the fishes; and, in return, the fish data bear significantly on the interpretations of physiography. The evolutionary relationships and history of many of the forms of fishes can be hypothecated with much greater assurance when we have, as we often do, clear-cut evidence on the past connections and disruptions of the isolated waters which are now inhabited by these forms. Conversely, when we discover a chain of closely related forms in separated springs or creeks through a section of the desert, we supply evidence that these now isolated waters are relics of a once wide-spread and connected lake or stream system (Figs. 6 and 7).

Deserts provide an especially opportune locale for correlating, to their mutual advancement, these studies of the history of fishes and of the waters they inhabit. The very paucity of the fish fauna simplifies the interpretations, and the few species are forced into radiative adaptations to fill the varied ecological niches. Profound hydrographic changes, which here leave an easily interpreted and long-lasting record (Figs. 2, 4 and 6), abound in the western desert lands—where mountains are growing, great sheets of lava often flow, and large cones of alluvium are deposited.

In the deserts we see in most dramatic operation the principle that fresh-water fishes, whether we think in terms of individuals or of species, of present or of past, are inseparably bound to the springs and streams and lakes which they inhabit. When any waters completely dry up, as they so often do in arid regions, the fish life perishes. When canyon creeks are transformed by cloudbursts into raging torrents that no living thing can resist (another desert phenomenon), the entire fish life is stranded on the normally dry flats.

Fish populations of desert regions become separated with special frequency into discrete units, ready to differentiate into subspecies or species. This happens when the waters which these fish have inhabited lose their former connections. As large lakes dry down to almost lifeless alkali flats, remnants of the formerly widespread fish populations often remain in

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* Delivered before Beta Chapter, University of Michigan, December 4, 1940.

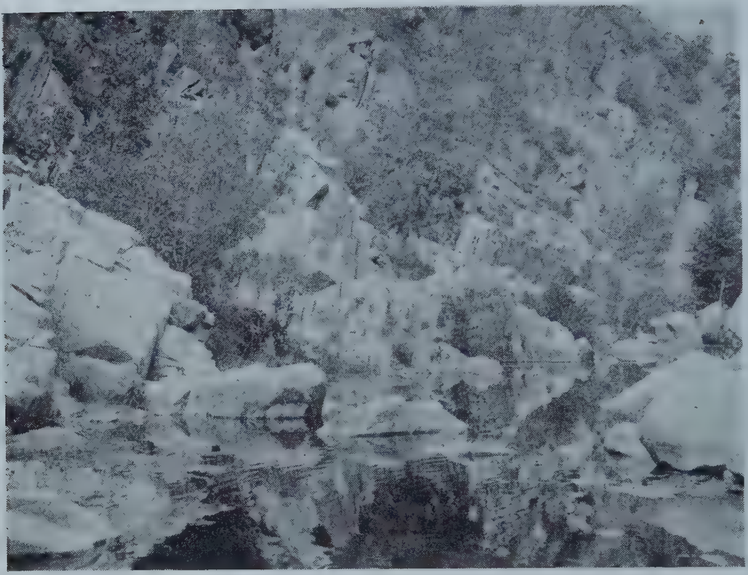

FIG. 1. LOWER END OF DEEP CREEK, MOHAVE DESERT, CALIFORNIA.

This stream drains a section of the desert slope of the San Bernardino Mountains of Southern California, and was formerly one of the headwaters of a vast interior basin that drained the Mohave Desert, Owens Valley and other arid areas, finally filling Death Valley. Immediately below this pool Deep Creek sinks into the desert sands—except in flood time. Here we took two chubs, one a new species, and many interspecific hybrids. In eras of more water, the parent species were undoubtedly separated, for one is a lake type, the other a stream form.

isolated springs (Figs. 2 and 3) on or around the old lake bed (Figs. 2, 4 and 6). Desert streams and their fish faunas are disrupted, when a reduced rainfall or an increased rate of evaporation so decreases the flow that the lower connecting courses can not be negotiated, because the waters either sink into the thirsty sands or, in times of flood, so quickly subside into the normally dry stream beds as to provide one-way, downstream passage only (Fig. 7). With still further aridity, the streams like the lakes dry up completely, save often for isolated springs, which with uninterrupted continuity maintain their own existence, and that of their fish life, over surprisingly long periods of aridity. Headwater populations of certain fishes, trouts for example, have become separated since the Ice Age, even where the streams maintain a connection, for the lower courses have become too warm to be tolerated by these cold-water species. Surface water connections and fish populations are likewise broken when a lava flow creeps across a stream course and freezes into a rock dam, behind which the upper waters evaporate or through which the water but not the fish may seep. The fish populations of a stream may be divided into two units when the beheaded upper course is diverted into another stream which has eroded its

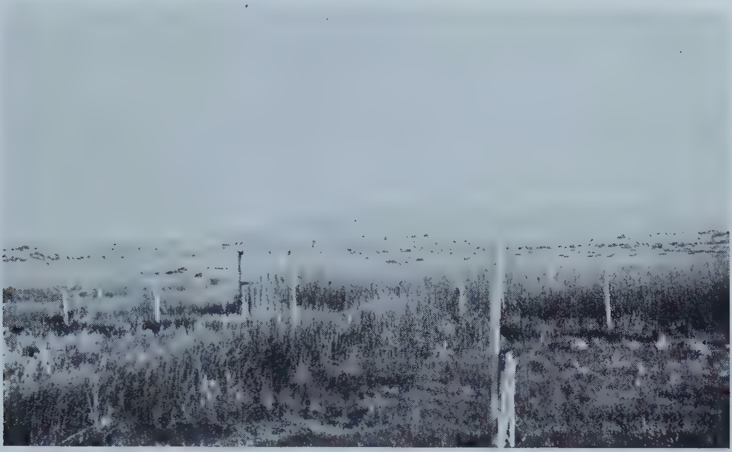

FIG. 2. ALKALI SPRING IN THE DESERT AREA OF OREGON.

The little water-hole in this tule patch contains all the water and all the remaining fish life of a once great body of water, which may be called Quaternary Alkali Lake. The sand dunes in mid-distance bound a small lake bed, and the clear-cut terraces which rim the ancient peninsula in the background tell of a lake perhaps 200 feet deep and hundreds of square miles in area. The ice-age waters no doubt teemed with fish life. Such isolated, relict fish populations as that now confined to Alkali Spring have naturally undergone some speciation.

course backward until it has captured part of the first stream. A similar result may be effected by a single desert stream through its own processes, as when the channel moves across a large alluvial fan or cone so as to carry the water with its fish life first into one stream system and then into another. Along the coast, streams and their fish populations are broken into parts when a change in the relative level of land and sea floods a former stream junction with salt water. Fluviatile fishes can not live in the ocean.

These are not imagined scenes in the drama of fish life in desert waters. At least once and usually often, the occurrence of each event can be demonstrated, or can be assumed on convincing evidence, to have occurred in western United States.

This study of the fish life of the desert regions of the American West is contributing facts and interpretations to ichthyology, to physiography, and to evolution.

Additions to the knowledge of fishes are the most direct result. The number of known kinds of fresh-water fishes in the American West is being more than doubled. At least 50 new subspecies and species have been discovered, largely in many small and separated drainage basins which have never been explored by others. Most of these novelties are slightly differentiated local forms which are being named as new subspecies, but others are fully differentiated species. One very distinct new genus (Fig. 5) has been described.

Chapters in the history of the water systems of the West are being elucidated, not only through the indirect bearing of present-day fish distribution on the former connections and

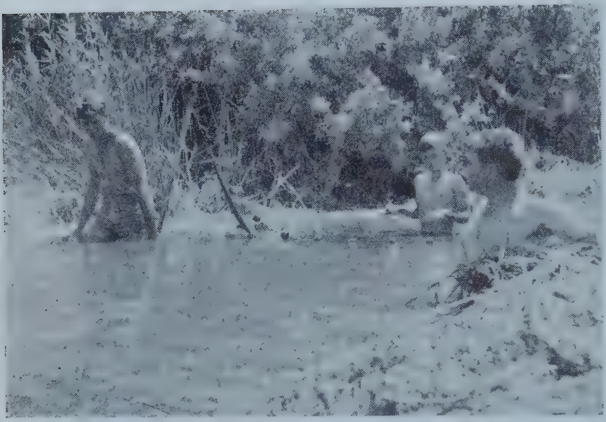

FIG. 3.
A FISH SPRING IN PLEASANT VALLEY, NEVADA.

Of the many little springs in Pleasant Valley and the other basins which constitute the Dixie Valley interior drainage system of Nevada, this is the only one in which fish life was located. Choked with vegetation this water hole had the breath-taking summer temperature of 58° F. After the tules had been removed, we seined out perhaps half of the total population of a new subspecies of Siphateles obesus, leaving of course a safe nucleus to perpetuate the form.

separations of the surface waters, but also through direct observations. Light is thus being thrown on what might be called the fossil hydrography of the Intermountain Region. Through an examination of physiographic features we learn that large streams once flowed permanently through now dry washes (Fig. 7), either to reach the main rivers that continue to the sea, or to feed the clear lakes and great inland seas which, in place of alkali flats, once floored the many basins in the area of interior drainage. Across the larger of the bare and level lake beds we may drive in any direction, foot down on the pedal and hands off the wheel if we wish, ever chasing the mirage of water which the heat waves cause to rise before us. Glancing back the mirage is seen to follow us, as though the ghost of the waters that once filled the basin were rushing to engulf us. As the coolness of the evening dispels these unreal waters, the mountains come forth in the ruggedness of their naked rock, in clearness that belies their distance. Across their bases, yet to a height of many hundreds of feet, are seen clear-cut as though formed yesterday, the level terraces and great sea cliffs (Figs. 2 and 4) which were cut by the very obviously real waters of former times. By reason of the dry climate, the terraces have been preserved through centuries with such fidelity that geological skill is not needed to interpret their significance. Great bars of wave-washed gravel, now bone-dry, also tell convincingly of former shore lines and strong currents (Fig. 6). The great Quaternary seas of the west—some comparable in area and depth with the Great Lakes—may have persisted long enough to have been gazed upon by desert Indians, who had legends of great waters. These seas, however, had evaporated into the dry desert air long before civilized man arrived to paint their glory in colors and words, to cover their surfaces with

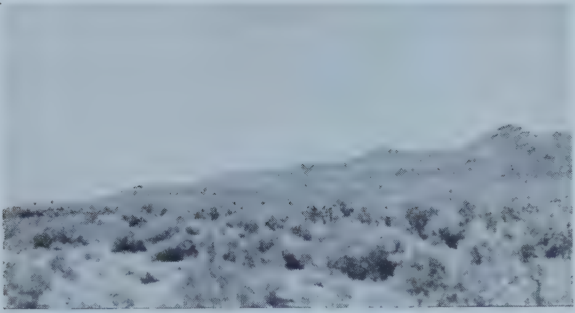

FIG. 4. THE NOW ALMOST WHOLLY DRY BED OF QUATERNARY DIAMOND LAKE, WHICH ONCE FILLED DIAMOND VALLEY STRETCHING NORTH FROM EUREKA, NEV.

The wave-cut terrace indicates the height of the ancient lake at outlet level. The terrace has been secondarily covered by a layer of angular fragments, but the underlying wave-washed gravel is exposed by rodent burrows. Altimeter readings of the highest terrace of Diamond Lake coincided with those of the crest of Railroad Canyon, proving that Diamond Valley and a large tributary area to the westward, opening through Devil's Gate, were once a part of the extensive Lake Lahontan system. The remnant fish fauna of these formerly tributary basins confirms the connection.

great ships of commerce, and to pollute their waters with the waste products of the great cities which would surely have arisen along their now dry and unpeopled shores.

Former connections between the waters of now separated basins have been demonstrated by following the lake terraces (Fig. 4) to gaps which must have served as overflow outlets, or by determining that the highest terraces have the same level as the assumed outlet canyon. Former stream courses again flow, in the mind's eye, through long stretches of desert washes (Fig. 7) that are now dry as dust, save for rare times of floods, born of the torrential precipitation of the desert. By charting ocean soundings the ancient confluence of certain Californian coastal streams through channels now lying deep beneath the sea, were verified by ichthyologists more than 20 years ago—before the study of submarine canyons became popular. The fact that the now wholly separated upper courses of these ancient stream systems are occupied by the same or very closely related fishes is, in my biological viewpoint, one of the most conclusive arguments that the lower courses which are now flooded by the sea were carved by fresh water.

As already mentioned, a combination of the facts and interpretations of ichthyology and of physiography makes it possible to postulate with considerable assurance the past history of numerous kinds of fishes in the desert region. This historical and kinetic approach provides an exceptional opportunity for an analysis of speciation (the origin and differentiation of species). Some of the resulting generalizations may be hastily stated:

(1) Isolation is a speciational factor of dominant importance. Nowhere else has the differentiation of freshwater fishes been on such a fine and clear-cut pattern, as in the desert region where portions of populations have been so extensively and so thoroughly separated.

(2) The rate of speciation under conditions of rigid isolation is much more rapid than has generally been

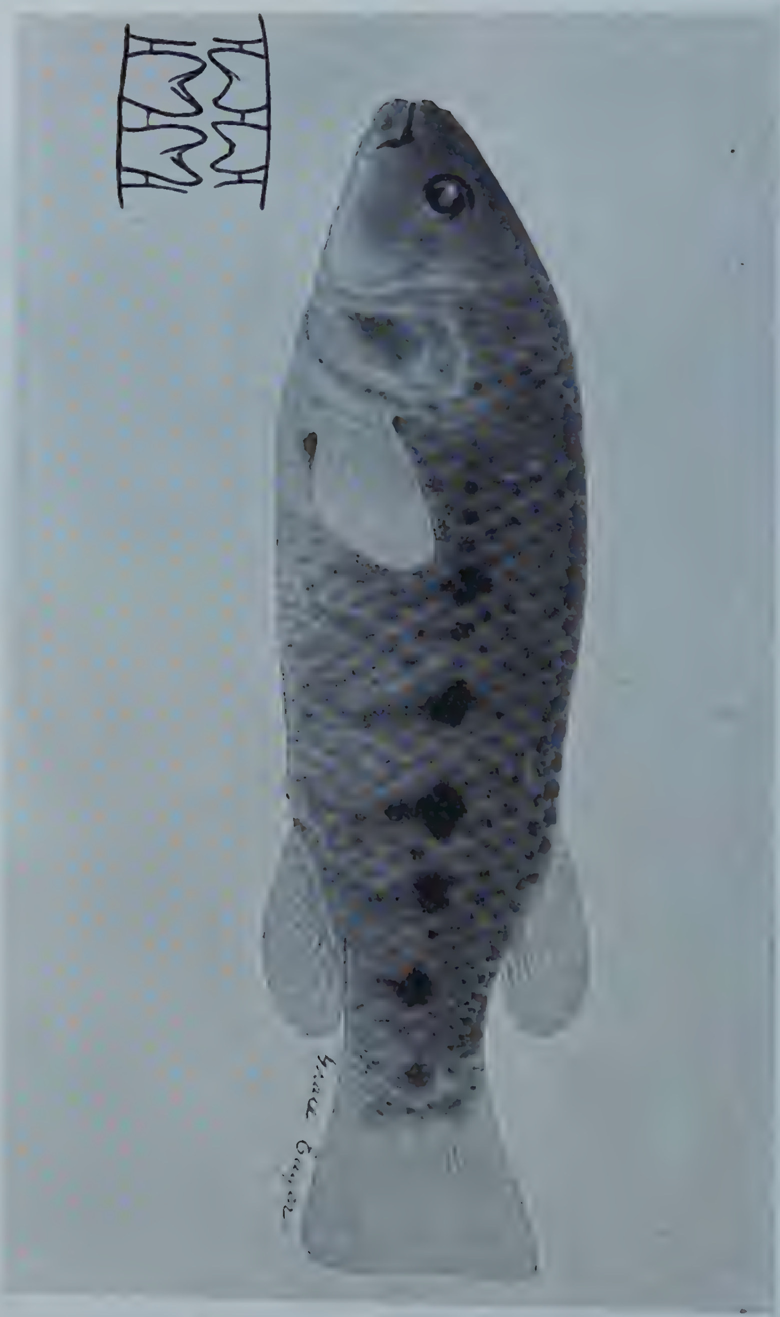

FIG. 5. CRENICHTHYS NEVADAE HUBBS.

This remarkable cyprinodont fish was recently described as a new genus and species. The two types were caught in a glass jar by Mrs. C. T. Brues, while accompanying Prof. Brues on an exploration of the fauna of the desert hot springs. Later we took thousands of specimens in various hot springs in Railroad Valley (Fig. 6), Nevada, to which the species is restricted.

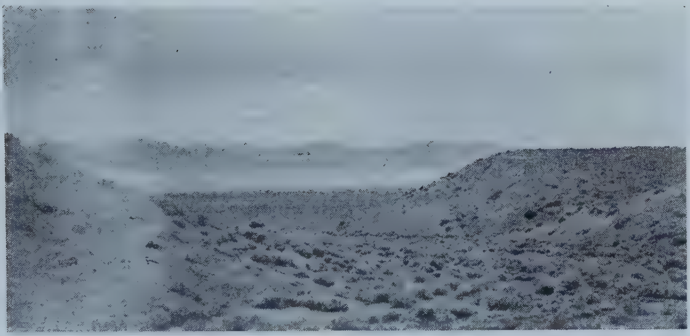

FIG. 6. THE BED AND SHORE FEATURES OF QUATERNARY RAILROAD LAKE.

The alkali flat was the central part of the old bed of one of the larger of the many minor ice-age Intermountain lakes. In the foreground, looming above the Expedition's car, is a bar of wave-washed gravel demonstrating the extent of the ancient lake and the strength of its shore currents. Several valleys to the westward drained into Railroad Valley through a gap in Pancake Range (shown in the background), but the stream system occupied an enclosed basin. The relict fish fauna comprises a series of subspecies of chubs (Siphateles), related to those of the Lahontan basin, and several populations of a peculiar species of cyprinodont, Crenichthys nevadae (Fig. 5).

supposed. Much of the differentiation of single Formenkreisen must have taken place since the last major flooding of the desert—an event commonly correlated by geologists with the late Wisconsin period, the last great advance of continental ice. Springs at the same level around the edges of some alkali flats were found to contain distinct kinds of fish, which must have differentiated from a type which occupied all of the lake that covered this flat in the most recent period of even moderately increased water supply—presumably only a few hundred and at most a few thousand years ago. (Figs. 6 and 7.)

(3) Isolated fish populations may persist, and differentiate rapidly, in numbers not exceeding a few hundred individuals and in habitats not equaling this room in volume (Figs. 2 and 3). Such relatively intense natural inbreeding may even accelerate the process of evolution, contrary to the ideas of some mathematically inclined geneticists.

(4) Dessication of waters has led to fusion as well as differentiation. Speciés which by their habits and by their feeding apparatus and other structures are adapted respectively to lake life and to stream life, and which in periods of ample water no doubt had a complementary distribution, have hybridized *very extensively* now that the two types have been forced into intimate contact in the isolated trickles and springs which represent the remnants of once expansive water systems (Fig. 1).

(5) Speciation may proceed under what seems to be almost identical conditions of existence, but the differentiation appears to be more frequent and more complete when the isolated populations are confined to waters of very different character. Speciation is seemingly a particularly rapid and extensive process in warm springs.

(6) In some forms and to some degree the direction of speciation appears to be random, but is often correlated definitely with the environment. In

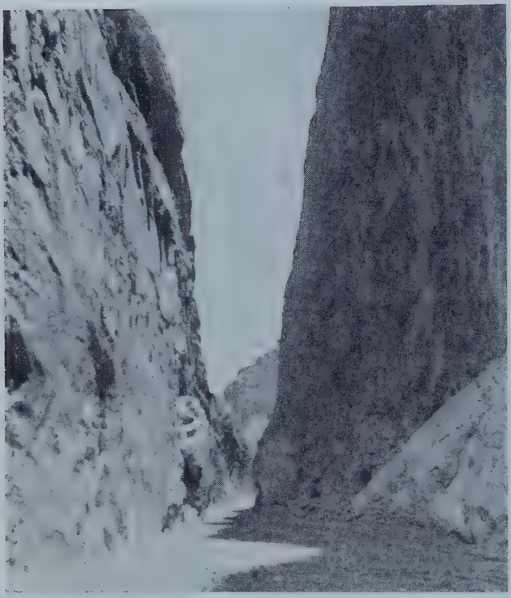

FIG. 7. ARROWHEAD CANYON, CLARK COUNTY, NEVADA.

The Quaternary White River once flowed through this cleft in the Arrow Range, to connect with Muddy River and the Colorado. The course of this ancient river has been traced on physiographic evidence from central Nevada to what is now Lake Mead. This stream course was also determined by the relict fish fauna, consisting of differentiated derivatives of the Colorado fauna and a chain of subspecies of Crenichthys baileyi, which is confined to this now greatly disrupted stream system.

warm springs the local forms tend to be small fishes, with large head and fins and with a reduced number of scales and fin-rays (these are general evolutionary trends in warm water). Further following the correlation of characters with the environment, I quote from my article on "Speciation of Fishes" in a recent number of the American Naturalist:

"Parallel speciation under the control of the environment has become strikingly evident during our recent studies of the fishes of the isolated waters of the arid American West. In the flowing streams, as already mentioned, the local forms of any species tend to have a stream-lined form, long and falcate fins and other characters enabling the fish the better to resist the current. The riffle inhabitants are designed for bottom-life and bottom-feeding, having flat ventral surfaces and arched dorsal contours, and inferior, more or less horizontal mouths. In the isolated springs these special modifications of form are lost. The mouth tends to become larger and more oblique, fitted to engulf food organisms living at various water levels, rather than to grub around the stones of the riffles. In correlation with a general freedom from predation, the populations become dense and the sense organs reduced. Thus, the barbelled minnows lose their barbels, and the lateral line becomes obsolescent. The scales tend to drop their orderly arrangement and their deep imbrication, and to develop radii on all fields. In three originally unlike genera the terminal modifications along this speciational line have become so nearly molded into the same form, that they falsely appear to be very closely related.

"Among the cyprinodont fishes, the desert-spring isolates tend to lose their pelvic fins [Fig. 5]. The loss has taken place in several regions and in several groups, and seems to be another example of the general tendency for animals to lose structures which are not of critical value under the environmental conditions to which they are subjected."

To anticipate a possible and justifiable criticism, I close by stating that the genetic significance of the observed differences in the fishes of the isolated waters is being subjected to experimental tests by my graduate student and Division assistant, Robert R. Miller, who is collaborating with me in these desert fish studies. His tests involve extensive transferences in nature, in which samples of one inbred population are being placed in fishless springs of diverse physical and chemical conditions, and in which supposedly differentiated types inhabiting waters of diverse character are being stocked in springs and garden pools with the same water conditions. Parallel experiments, more precise perhaps but less satisfying in other respects, are being run in aquaria.

The combination of such observational and experimental studies on the desert fishes, correlated with the facts and interpretations of physiography, will it is hoped lead to a better understanding of speciation, a central problem of biology.

AMERICAN SOCIETY OF ICHTHYOLOGISTS AND HERPETOLOGISTS

FLORIDA MEETING AT GAINESVILLE

April 3-5, 1941

The members of the American Society of Ichthyologists and Herpetologists and their wives are cordially invited to attend the Twenty-fourth Annual Meeting of the Society which will take place at the University of Florida in Gainesville, Florida, from Thursday, April 3, to Saturday, April 5, 1941. All sessions will be held in the Chemistry Auditorium, University of Florida. The Annual Dinner will be given at the White House, Gainesville, on Thursday, April 3, and an outdoor supper is planned for the evening of April 4. There will be a meeting of the Board of Governors on Wednesday evening, April 2.

PAPERS

Titles of papers to be presented at the meeting must be in the hands of the Secretary of the Local Committee before March 1. It will be of assistance to those preparing the program if an accurate estimate of the time required for each paper is submitted with the title. It is hoped that no paper will require more than fifteen minutes.

HEADQUARTERS

The White House, located at 508 East Main St., North, Gainesville, will be Society Headquarters. Rates are: single, $1.50, $2.00 and $2.50; double, $2.50, $3.00 and $3.50.

Accommodation in other hotels and in private homes is also available. If you desire to make reservations in advance you may do so by writing to the White House, Gainesville, or to the Secretary of the Local Committee, C. J. Goin, Biology Department, University of Florida, Gainesville.

Chapter News Letters

Mu

—University of California

Mu chapter has concluded its program for the fall semester. Five meetings were held, two of which have already been reported for the *Biologist.* Sixteen new members (15 active and one faculty) have been initiated into the chapter. They are: Levi T. Burcham (Forestry), Harold L. Gentry (Forestry), J. Richard Gililland (Fruit Products), Frank W. Gould (Botany), James W. Hansen (Agricultural chemistry), Robert H. Hansen (Hygiene), Irena A. Heindl (Protozoology), Milton Hildebrand (Zoology), F. Douglas Horn (Entomology), Eder Lindsay (Entomology), Charles M. Miller (Zoology), John H. Powell (Forestry), Virginia C. Ray (Paleontology), Dr. K. A. Salman (Faculty), Henry Schneider (Plant Pathology) and Toshi W. Yamazaki (Fruit Products). Dr. Salman, a forest entomologist, is Lecturer in Entomology at the University and connected with the U. S. Department of Agriculture. He is chiefly interested in forest insect ecology.

Mr. Robert W. Hiatt has succeeded to the office of Vice-president, his predecessor having gone to U.C.L.A. Mu chapter has created a faculty advisory board which will meet with the executive committee to consider the program and general policy of the chapter. The executive committee has selected the following for the current year: Professors E. B. Babcock (Genetics), C. L. Camp (Paleontology), E. O. Essig (Entomology) and E. R. Hall (Zoology). It is believed that the faculty advisory board will bring about a more satisfactory selection of new members and create better student-faculty relationships.

At the business meeting held October 15th, following the election of new members, Professor E. O. Essig demonstrated what a biologist can do with kodachrome. His pictures featured particularly the plant life of northern California and illustrated the potentialities of such work in teaching and research.

On November 6th we met at the home of Dr. Guy F. MacLeod, of the Division of Entomology. Our host gave us an illustrated talk on some effects of x-rays and infra-red radiation on insects and presented x-ray moving pictures of living mealworms. The peristaltic movements of the alimentary canal were clearly visible.

At the initiation banquet on December 3rd, we had the pleasure of hearing Professor S. F. Cook of the Department of Physiology tell of his work with the California Indians. He has attempted to discover the biological factors underlying the population decline of these people who came under the influence of the Spanish missions before the arrival of the Americans. The discussion which followed revealed some of the ramifications of this interesting problem.

NATHAN STAHLER, *Secretary.*

Omega

—University of Oklahoma

The annual fall formal initiation of Omega chapter was held on Friday, November 22. In this service the following members were initiated: Norma Jean Brown, Frances Cummings, Mary Catherine Fitter, Francis Hollingsworth, Thomas McCoy, Wayne Randel, and Emil Stratton of the Zoology Department; and Gordon Buffington, E. E. Dale, Jr., Anna B. Fisher, Felton Nease, Jessie Richter, Julian Marie Riddle, Herbert Taylor, and Maurice Winston of the Botany Department; and Margaret Tribble and Mary Lynn Westervelt of the Geology Department. Immediately following the initiation a banquet was held in honor of the new members. The speaker of the evening was Dr. S. W. Geiser, head of the Biology Department of Southern Methodist University at Dallas, Texas. Over a period of fifteen years Dr. Geiser has published a number of papers on frontier naturalists. His subject for the evening was "Exploring the Southwest for Explorers."

On December 6th and 7th the Oklahoma Academy of Science held its annual fall meeting at the University of Oklahoma. Many interesting papers were read, several of them contributed by members of Omega chapter of Phi Sigma. The guest speaker at the Academy was Dr. George T. Moore, Director of the Missouri Botanical Garden, St. Louis, Missouri. Dr. Moore's address, "On Being Scientific," was one of the most informative and yet one of the cleverest addresses that it has been our privilege to hear. He completely exploded the myth that either Science or scientists are infallible. He contends that some people consider "research" as "having a problem," and went on to say that while many of us had our problems, we did not consider them "research." He also believes that a person may be scientific without burying his findings in long-drawn sentences composed of complicated scientific terms because the real purpose of recording findings is to pass them on. The Academy meeting closed with a luncheon at which Dr. G. L. Cross, head of the Department of Botany and Bacteriology of the University of Oklahoma talked on "Growth Regulators and Plant Propagation."

Our weekly radio programs over station WNAD are being presented in cooperation with the Physics Club, Physiology Club, Sigma Gamma Epsilon, Chi Epsilon, and Alpha Chi Epsilon on this campus. The programs were made up from the outline of the state-adopted general science text. The programs are essentially designed for high school students and have quite a large audience over the state.

DOROTHY RAINWATER, *Secretary.*

Psi

—University of Washington

Last spring Lt. James Dawson was elected president of Psi chapter but he had to resign this fall when called to active duty in the army. Mr. Trainer, the vice-president, became president.

Last May the following students were initiated into active membership: Ruby Curtiss, Buster Holiday, Stanley Nicolay, Bart Proper, Jean Ross, Pat Wick, and Roy Strickland.

The last spring scientific meeting consisted of a symposium on "Evolution." Dr. Earl Harris of Biochemistry traced some of the theories of inorganic and organic compounds and showed the close relationships of many of the compounds occurring in plants and animals. Dr. John E. Guberlet discussed the general theories and main facts concerned with organic evolution. Dr. Verne Ray concluded the series with a discussion of the principles involved in human evolution.

Dr. Rachel Hoffstadt addressed the first fall meeting on "Health Hazards in War." She stressed the types of diseases which occur and the progress we have made since the last war in combating these epidemics.

ELOISE KUNTZ, *Secretary.*

Sigma

—University of Florida

Sigma Chapter held its annual banquet and initiation at the Primrose Grill on December 6, 1940. Immediately after the dinner, Dr. Horton Hobbs acted as Master of Ceremonies in a "Take it or leave it" program in which the initiates participated. The questions were of a biological nature and candy mints were given as prizes for those answering the questions correctly.

Following the "Take it or leave it" program the following candidates were initiated:

W. J. K. Harkness—Honorary, Robert Ray Mulligan—Faculty, Joseph C. Alvarez, Marie Yvonne Brannon, Joshua C. Dickinson, Jr., David Lee Emerson, Jr., Daniel B. Fogarty, William A. McLane, Robert S. McLean, Emilia H. de Nunez, Esteban Nunez-Melendez, Warren C. Strickland, Robert O. Thomas.

Professor Harkness, who was elected an honorary member, is an exchange professor at this institution from the University of Toronto. He has published many papers on limnology and is president of the Limnological Society of America and vice-president of the American Society of Ichthyologists and Herpetologists. Sigma Chapter is proud to have him as an honorary member.

The feature of the evening was a talk by Professor Harkness on "Ducks

Unlimited, Canada." This company, Professor Harkness said, was organized in 1937 as a subsidiary of "Ducks Unlimited, Incorporated." The headquarters are in Winnipeg, and it is controlled by a board of directors consisting of five American members and five Canadian members. Ducks Unlimited was organized for the purpose of producing more ducks. This work is carried on by the building of large dams and the introduction of beaver to build smaller dams, thus increasing the water area and breeding grounds. Furthermore, a protective patrol guards the ducks against destruction by predators, fire and drought. Ducks Unlimited gives the following estimates of duck population for Western Canada:

1935—40,500,000
1938—49,044,000
1939—59,682,000

They feel that this increase has been brought about largely through the increase and protection of the breeding areas.

Coleman J. Goin, *Secretary.*

Alpha Epsilon

—University of Pittsburgh

Albert G. Smith, one of our newest members, has just had the following paper published in the Carnegie Museum Annals: Notes on the Reproduction of the Northern Copperhead, Agkistrodon mokasen cupreus (Rafinesque) in Pennsylvania.

Alpha Epsilon Chapter is proud to announce the following program for the year 1940-1941:

September 27. Fall Picnic—Riverview Park—Visit to Observatory.

October 11. Dr. Alfred E. Emerson—University of Chicago—"Speciation."

November 21. Phi Sigma—Guests of Collembolae.

December 13. Dr. Shapera—Medical School — University of Pittsburgh, "Shock Treatment in Mental Diseases."

December 18. Joint Collembolae—Phi Sigma—Christmas Dance.

January 10. Dr. Walter Sweadner—Erie Center—University of Pittsburgh, "Bug Hunter in Everglades."

February 14. Initiation and Banquet—Dr. L. Cartledge—University of West Virginia, "Human Heredity."

March 14. The Biological Aspects of Japanese Beetle Control—U. S. Department of Agriculture Representative. Collembolae—Guests of Phi Sigma.

April 18. Walter Rome—Juvenile Court—Pittsburgh, "The Court and the Child."

May 1-2. Research Exhibit. Joint—Department of Biology—Department of Geology—Phi Sigma.

May 23. Annual Picnic.

The first three events scheduled have been very successful. They have been attended by large numbers of our members who have brought guests with them. We are hoping to make our research exhibit the largest event of the year. By having the two departments cooperate with Phi Sigma we can have three floors of the Cathedral of Learning open for the exhibit. We expect to invite the Biology classes of the local High Schools to attend. The exhibit will have displays of general interest, methods of teaching, demonstrations and of course the main part and the important part will be the display of results of the research work of the various members of the society.

Edna Higbee, *Secretary.*

Alpha Iota

—Bucknell University

During Freshman week this fall the chapter assisted the Biology Department at an informal meeting for the freshman biology students; this was planned to help these new students in making acquaintances and to give them a chance to discuss any questions concerning courses or college life. Since then the chapter has developed a counselling program for these new students.

On September 26th, an initiation ceremony was held for Robert E. Thomas, '41.

In October we had an outing which was attended by about 35 biology students.

On November 12th, Mrs. Anna dePlanter Bowes, Chief of the Division of Nutrition, Pennsylvania Department of Public Health, gave a talk on "Food and Life" at an open meeting.

On December 5th, Dr. Walter H. Judd, a medical missionary who has been a surgeon in the hospitals of China, attended a luncheon sponsored by the chapter. Following the luncheon he spoke at an open meeting on the topic, "A Scientist Thinks Creatively."

During the fall the chapter has sponsored hikes to stimulate interest in biology and hiking. Different professors accompanied the groups to help identify specimens found. These hikes were very successful so we are planning to continue them.

At the January meeting Professor William H. Eyster, Professor of Botany, will be the speaker.

JANET CLAYTON, *President.*

Alpha Xi

—Rhode Island State College

On October 10 the chapter held a very interesting informal discussion on the subject "Vitalism vs. Mechanism" to which candidates for membership were invited. On November 14 the following people became members of the chapter: William Barry, Edward Cardillo, Robert Cheetham, Edward Cubler, Lester Friedman, Yale Gordon, Ruth Hannah, Carl Henrikson, Donald Johnstone, Patrick McCaskey, Milton McVay, Douglas Seigal, and Elinor Suitor. After the initiation ceremony, two faculty members, Dr. Kenneth E. Wright and Prof. Robert DeWolf, discussed the subject of whether or not there are special sex-determining chromosomes in organisms. The new members are preparing papers on subjects of biological interest to read before the society at future meetings. On December 1 the chapter met informally at the home of one of the faculty advisors, Dr. Francis Hunter, to discuss current topics of interest in science. The discussion centered around growth of plants in culture solutions. A Christmas party at the home of the other faculty advisor, Prof. Robert DeWolf, was substituted for the regular December meeting. The chapter is planning to hold a dance soon in cooperation with the Chemistry Society of the college.

BOTANICAL RESEARCH:

Dr. Vernon I. Cheadle is carrying on a broad survey of the monocotyledonous plants to study the conductive elements in xylem and phloem in an effort to work out their specialization as it is illustrated in (1) the form and structure of the elements, and (2) the relation of the elements to one another and to the vascular bundle itself. The routine work has progressed to the point where 275 species representing 40 families have been collected and 5,500 slides of macerated and sectioned material have been prepared.

Dr. Kenneth E. Wright has previously published research indicating that aluminum toxicity may be due in part to the internal precipitation of phosphorus by aluminum, a viewpoint contrary to the external precipitation theory advanced by previous workers. As a further check on the internal precipitation idea, aluminum toxic plants are now being analyzed for soluble and insoluble phosphorus, the latter being fractioned into organic and inorganic phosphorus. In comparison with check plants, the inorganic phosphorus content should throw some light upon the idea of internal precipitation.

Dr. Frank L. Howard, plant pathologist, has completed two research papers for presentation at the Philadelphia meeting of the American Association for the Advancement of Science: "Studies of the Resistance of Eggplant varieties to *Phomopsis* blight," and "The Role of Tree Injection in the Control of Bleeding Canker of Hardwood."

ZOOLOGICAL RESEARCH:

Narragansett Marine Laboratory, which was completely destroyed in the hurricane of 1938, has been rebuilt; field work was resumed last April. Dr. Charles J. Fish is director of the laboratory, and Prof. Robert DeWolf is assistant director. Other Phi Sigma members active in the work are Edgar Arnold and Norman T. Allen. Facilities will be afforded for guest investigators whose problems are correlated with the present research program. A vessel and crew are available from April until September. The laboratory is purely a research institution and as yet no facilities for classes are available. The laboratory is engaged in research on marine biology and the problems of fishery conservation. It is completely equipped for all types of oceanographic investigation and the programs are carried out in cooperation with the Federal Bureau of Fisheries, the State Department of Fish and Game and other marine laboratories. At the present time the following studies are being carried on:

1. Biology of the Flounder population in Rhode Island waters.
2. Distribution of Striped Bass in Rhode Island waters with special reference to possible local production. This is a cooperative study with the Federal Fish and Wildlife Service.
3. Production and dispersal of young fish in Narragansett Bay.
4. Biology of the Starfish population with the objective of developing methods of control.
5. Comparative anatomical racial studies on Winter Flounder.
6. Hydrography of Narragansett Bay with special reference to non-tidal drift and mechanical mixing in estuaries.
7. Biology of the plankton population.
8. Experimental biological and physiological studies.

The library which was destroyed with the former laboratory has been largely replaced through the generosity of various private and governmental institutions. The staff ichthyologist, Marie P. Fish, was honored by the Centennial Women's Congress in New York City with the award presented to the one hundred leading professional women in the United States.

Dr. Francis R. Hunter is carrying on research in Cell Permeability and Cell Respiration. He is assisted by the following members of Phi Sigma: William G. Banfield, Saul Barber, Anthony Caputi, Elmer Heffernon, Douglas Seigal, Louis D. Stringer, and Elinor Suitor.

At the Rhode Island State College Agricultural Experiment Station, various members of Phi Sigma Society are engaged in active research. Dr. Basil E. Gilbert, Director of the experiment station, is in charge of research in Plant Physiology. Prof. George E. Durham has been conducting experiments to determine "The Influence of Waxing on the Nutrient Properties of Potatoes." Waxing has been found to reduce the rate of starch transformation. Dr. Theodore Odland, agronomist, has been experimenting to determine the fertilizer requirements of various crops. New varieties and strains of farm and vegetable crops have been tested and cultural work done on them. Experiments with the breeding of alfalfa and of Rhode Island Colonial Bent Grass have been carried on in an attempt to improve alfalfa so that it will be better adapted to conditions in Rhode Island, and to develop a better pasture type of Bent Grass. Work is being done on potato crops in cooperation with the United States Department of Agriculture to test and develop new varieties.

Sylvia Ann Howland, *Secretary.*

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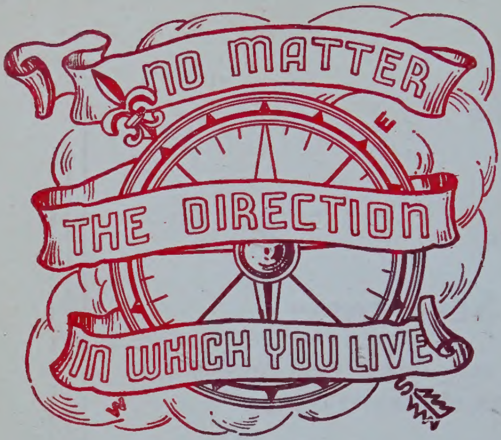

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